2014

An Analysis of Convertible Bond Issuance: Design Features, Market Conditions and Private Placement

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Bachelor of Science
University of Michigan, 2010

Submitted in Partial Fulfillment of the Requirements

For the Degree of Master of Science in

Business Administration

Darla Moore School of Business

2014

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Abstract

Over the last two decades convertible debt issues have been steadily increasing in both frequency and magnitude and several high volume issuance periods. Although convertible debt issuance is inherently influenced by debt and equity market volatilities, the convertible market has been shown to have an independent presence in terms of issuance volume, issue design and market participants.Are concerns of asset substitution, risk uncertainty, or asymmetric information the primary factors in convertible debt design, timing and placement? This paper aims to examine how the design of convertible bonds and the characteristics of convertible issuers shift over time and under different market conditions. I find that design features of convertible issues are not chosen independent to broader convertible debt markets conditions or firm-specific financial constraints. I also identify a strong relationship between private-placement activity and convertible debt issues designed with more equity-issuance characteristics.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Over the last two decades convertible debt issues have been steadily increasing in both frequency and magnitude and have endured several high volume issuance periods. Although convertible debt are inherently influenced by both debt and equity market volatility, the convertible debt market has been shown to have an independent presence in term of issuance volume, issue design and market participants (Dutordoir and Van de Gucht 2007; Lewis,Rogalski, and Seward 1999; Choi, Getmansky, Henderson and Tookes 2010).

This paper aims to examine how the design of convertible bonds and the characteristics of convertible issuers shift over time and under different market conditions. Are concerns of asset substitution, risk uncertainty, or asymmetric information the primary factors in convertible debt design, timing and placement? Specifically, I test the hypotheses that equity-like issues are more likely to occur during hot convertible markets, that a firm's need for external financing influences their likelihood to issue convertible debt designed as debt-like,hedge-like, or equity-like and that the private placement of convertible debt is prevalent and significant, regardless of the debt-,hedge-, or equity-like convertible design.

Convertible bonds are a hybrid security with debt and equity attributes. These securities contain a conversion provision which allows the owner to convert the original bond into shares of the issuers' stock when that stock reaches a predetermined price. Convertible bonds maintain coupon payments until maturity but if converted to equity the holder would be entitled to shareholder returns like dividends and repurchases. Thus the conversion option is valuable and this value is typically discounted from the initial bonds' coupon rate, though the conversion option discount may not be a permanent. If bondholders exercise their conversion option, equity-holders will have to absorb the cost

of share dilution. Convertible bonds may also contain a call provision giving the issuer the right to recall outstanding bonds under terms disclosed in the initial contract. These unique features allow the issuers of convertible debt a range of flexibility to tailor their securities in a manner that mitigates or resolves firm specific concerns.

Chapter 2: Literature Review

Theories of Convertible Bond Issuance

The literature addressing why convertible bonds exist suggest that convertibles may serve as an alternative to common equity, a mechanism to curb agency problems of managerial over-investment, bondholder expropriation, or as a primary financing tool when firm risk is uncertain.

Stein (1992) presents the theoretical argument that due to information asymmetry problems, medium quality firms with positive prospects will issue callable convertible bonds as a least costly method to increase equity holdings. Stein's "back-door equity" hypothesis has been generally supported in empirical studies and is most evident in Davidson, Glascock and Schwarz (1995) and Lewis,Rogalski, and Seward (1999). Within a sample of 118 convertible bonds issued between 1980-1985 Davidson et al (1995) analyzed whether conversion prices (ratios) were perceived by the market as a credible signal of future earnings. It took roughly 1.5 years for their sample's stocks to reach the conversion price. This relatively quick stock price improvement is consistent with the back-door equity hypothesis. Lewis et al (1999) examine 203 convertible debt issues, 259 straight debt issues, and 182 common equity issues between 1977-1984 to primarily assess the backdoor-equity and risk-shifting hypothesis. They document significant variation in market reaction to new convertible debt issues depending on whether investors expect the motivation for issuance to be asset substitution (back-door equity) or asymmetric information (risk-shifting). Their results suggest that both motives explain the use and design of convertible debt. Stein (1992) is also supported in the comprehensive survey of CFO financing decisions by Graham and Harvey (2001). However a survey

concentrated on the motivating factors considered by managers who issue(ed) convertible bonds conducted by Dong, Dutordoir and Veld (2013 working paper) does not find that managers incentives are aligned with the back-door equity hypothesis .

Mayers (1998) argues that firms with uncertain future investment opportunities will issue convertibles to mitigate potential agency problems, between managers and all stakeholders, of over-investment (Jensen 1986). Under this "sequential financing" hypothesis when an investment opportunity is deemed valuable the firm will use it's call option to force the bonds conversion and reduce it's leverage (distress risk). Otherwise conversion will not occur and managers will be liable to repay the outstanding bonds, averting the potential to waste the cash. Mayers (1998) examines the investment expenditures that lag 289 convertible calls between 1971-1990 and finds a positive relationship between the time of the call and changes in capital expenditures.The sequential financing hypothesis has received mixed empirical support from Chang, Chen and Liu[1] (2004) and Lewis et al. (1999) and weak survey support from Dong et al. (2013).

Green (1984) developed a theoretical "risk-shifting" model in which the conversion option embedded in convertible bonds serves to mitigate shareholder/bondholder agency problems that exist within straight bonds. On the basis that shareholders in firms with straight debt are less liable for losses from risky projects, the dilution potential of the conversion option should be a sufficient mechanism to curb shareholder risk taking. Conversely, Brennan and Schwartz (1988) argue that convertible bonds are relatively insensitive to firm risk because of their hybrid nature. Higher risk will reduce the value of the debt portion of the convertible but this effect is offset by appreciation in the equity option due to the firms' riskier activity. In this regard, convertible bonds can mitigate debt undervaluation problems that ensue from different assessments of firm risk between managers and outsiders.

Brennan and Kraus (1987) develop a "risk-estimation" hypothesis in which investment

[1] Chang, Chen and Liu (2004) directly test the sequential financing hypothesis for 109 convertible bonds issued by Taiwanese firms between 1990-1999 and find support for Mayers (1998)

inefficiencies due to information asymmetry about the firms current and future risk are mitigated by the use of convertible bonds. In their model a firms decision to issue convertible bonds, junior bonds or bonds with warrants effectively signals their riskier type and resolves adverse selection. The literature yields limited direct empirical support for the risk-estimation hypothesis within U.S. corporations [2] . However, survey evidence from Dong et al. (2013) is consistent with the Brennan and Kruas (1987) model as only financially constrained participants reported their rational to issue convertibles was motivated by necessity and not cost of capital or timing concerns.

Convertible Bond Design

If the primary theories of convertible debt issuance are accurate they should manifest in the design features chosen by the issuers of convertible securities (e.g. time to maturity, conversion price, call provision). In this regard, a branch of empirical literature focuses on the intent and reception of different convertible debt designs.

Lewis, Rogalski, and Seward (2003) classified convertible debt issuers as being equity-, hedge-, or debt-like based on the design characteristics of their convertible offers and a measure of their likelihood to convert the issue into equity. Using a sample of 588 convertible offers issued between 1978-1992. They thoroughly examined issuer[3] , issue and industry specific attributes as well as market reactions to each issuer category.With the implicit assumption that firms (managers) strategically select the terms of their convertible issues, the design categories reflect distinct underlying combinations of high debt- and/or

[2]Dutordoir and Van de Dutch (2007) suggest that risk-shifting may be a factor in the convertible issues by Western European firms

[3]Lewis, Rogalski, and Seward (2003) show that debt-like issuers were larger firms with highly volatile equity values, lower growth rates, more profitable investment opportunities and higher leverage than industry peers. Hedge-like issuers were large firms in low-growth industries with fewer investment opportunities and average volatility relative to other issuers and industry-peers. Equity-like issuers were small firms in industries with profitable growth opportunities who invested at very high rates compared to debt- and hedge-like issuers.

equity-related costs of external finance (e.g. market-to-book ratios, investment opportunity levels and probability of execution). More directly, firms trying to combat concerns of asset substitution or over-investment issue debt-like convertibles; firms dealing with asymmetric information issues and concerns of risk uncertainty issue hedge-like convertibles; and firms trying to combat adverse selection and high equity financing cost issued equity-like convertibles.

Specifically, Lewis et al measured the impact of investment-related performance variables as well as debt- and equity-related financing variables on excess returns for a two-day window around the convertible issue announcement date. For debt-like issuers investor reactions were significantly influenced by the financing-related variables only . Fluctuations in debt-like issuer's debt-related external financing followed expected trends for changes in profitability and stock price volatility. Yet high levels of financial slack, a measure of internal cash flows and a equity-related cost of external finance, positively impacted investor reactions. Noting that debt-like issuers likely face adverse selection barriers to equity-issuance, this positive result suggest that investors perceive convertible issues as good news when the announcements comes from debt-like issuers. For hedge-like issuers investor reactions were significantly influenced by both investment-related performance variables as well as financing-related variables. Since hedge-like issuers were highly-leveraged firms, the results suggest that designing hedge-like convertible issues did not full mitigate investors concerns about risk and adverse selection. For equity-like issuers investor reactions were significantly influenced by investment-related performance variables and moderately influenced by the equity-related internal slack variable. The explanatory investment and financing-related variables were industry-adjusted so informed investors could discern the firms motivations and intents (i.e. reactions to firms with more profitable investment opportunities were positive). Consistent with Stein (1992), these results indicate that equity-like issuers do issue convertible debt to overcome adverse selection problems.

Korkeamaki and Moore (2004) concentrate on the call provision design feature to determine a firm's potential for sequential financing needs. They categorize the issuer determined call provisions into four categories no protection, soft protection, hard protection, absolute protection. These classifications are used to assess the strength of an issuers intent to follow the sequential financing hypothesis. Korkeamaki and Moore (2004) find that convertibles with weak (no) call protections are offered by firms who increase investment activities shortly after the convertible issue. These results can be slightly more generalized to say that firms with weak (no) call protections are more likely to force(call) equity conversions before the security can reach the conversion price or maturity.

Issuance Timing and Market Reactions

Given the hybrid nature of convertible bonds some, interaction between the market movement of pure debt and equity securities should be expected and several studies have examined the extent of these interactions. Billingsley, Lamy, and Thompson (1998) found that only equity market forecast influenced firm-level decisions to issue convertible debt and Mann, Moore and Ramanlal (1999) found that a significant amount of convertible issues were linked to aggregate equity market volatility. More recently, Dutordoir and Van de Gucht (2007) tested the influence of aggregate debt, equity, and convertible issue volumes on the level of convertible debt-related financing cost. They applied Bayless and Chaplinsky's (1996) market timing theory and identification strategy and found that, similar to debt and equity securities, hot and cold convertible market windows exist. More importantly, Dutordoir and Van de Gucht (2007) show that stock price reactions to convertible issues are the least volatile during hot convertible markets specifically, as

oppose to hot equity[4] or hot debt markets.The notion of stand alone hot(not-hot) convertible debt markets is substantiated by Choi, Getmansky, Henderson and Tookes (2010) who detail the role of convertible bond arbitrage hedge funds as the primary suppliers of capital to convertible debt issuers. Choi et al (2010) show that arbitrage hedge-funds uniquely affect convertible debt markets as capital suppliers who compliment demand-side issuance factors (i.e. financial and investment constraints which are tied to debt and equity markets).

Throughout the empirical literature it has been well established that stock price reactions to convertible bond issues are less volatile than reactions to pure equity issues but more negative than reactions to straight bond issues (Dan and Mikkelson, 1984; Mikkelson and Partch, 1986; Lewis, Rogalski and Seward,1999). Consistent with this trend, market reactions to privately placed convertible debts have been much less volatile than reactions to publicly placed convertible debts as well as privately placed equity issues (Fields and Mais, 1991). If private placement signals the true or better quality of a firm, these patterns in market reaction volatility mimic theoretical expectations of asymmetric information and type-revelation.

[4]Within broader debt and equity markets,hot equity markets are unique periods when investor's are less scrutinous of idioscyncratic risk and issue-specific design features (Bayless and Chaplinksy,1996).

Chapter 3: Hypothesis Development

The following hypothesis are presented in order of intuitive logic and are built upon the extent empirical literature on convertible debt design, timing and market reaction.

ln the examination of market reactions to the investment opportunities and external finance cost of debt-, hedge- and equity-like issuers, Lewis et al (2003) found that the most volatile market reactions were for the investment-related performance variables of firms offering equity-like issues. This suggests that issuers of equity-like offers may experience the highest convertible-debt related financing cost. Dutordoir and Van de Gucht (2007) show that hot convertible debt markets represent periods with lower convertible debt-related financing cost. Consistent with Bayless and Chaplinsky's (1997) analysis of investor behavior during hot equity markets, Dutordoir and Van de Gucht (2007) suspect investors are less scrutinous of both issuer characteristics and issue design during hot convertible markets. This set of literature suggest that firms with high convertible debt-related financing cost, i.e. firms with high asymmetric information problems that issue equity-like convertible debts, stand to benefit the most by timing their equity-like convertible offer during a hot convertible debt market.

H1: Equity-like issues are more likely to occur during hot convertible markets.

The survey and empirical analysis in the Dong, Dutordoir and Veld (2013 working paper) notes that firms whose convertible principal issue amount constituted a large fraction of their total assets, were motivated to issue convertible debt because it was their only way to access capital. Lewis, Rogalski and Seward (2003) demonstrate that firms (managers)

strategically select the terms of their convertible debt issues in order to mitigate firm specific financing and investment-related costs. If the ratio of convertible principal issue amounts to total assets reflects a firm's need for external financing, firms with different levels of external financing needs will choose to issue convertible debts with different design features. A firm's level of external financing needs should be evident in its amount of internal equity slack. Slack reflects adverse selection cost and is typically used as a measure of internal cash flows and equity-related cost of external finance. A firm with high external financing needs ("high-need") may have low internal slack or low equity-related financing cost which is an attribute Lewis et al (2003) show persist for issuers of debt-like convertible offers . Conversely, firms with low external financing needs may have high slack or high equity-related financing cost which Lewis et al (2003) show persist for issuers of equity-like convertible offers.

H2: A firm's need for external financing influences their likelihood to issue convertible debt designed as debt-like,hedge-like, or equity-like

The literature discussing convertible debts and private placement activity or market reactions is very limited. Primary evidence from the single analysis by (Fields and Mais, 1991) shows that investors have significant positive reactions to the private placement of convertible debts. To the extent that we expect the design of debt-, hedge- and equity-like convertible issue to mitigate respective market imperfections, private placement activity should occur for convertible issues from each design subset. Similar logic can be extended to the external financing need level of a firm issuing convertible debt.

H3: Private Placement of convertible debt is prevalent and significant, regardless of the debt-,hedge-, or equity-like convertible design

Chapter 4: Data & Sample Construction

Straight and convertible bond issue data, excluding mortgage related, seasoned equity and preferred stock securities, were obtained from the Securities Database Corporation (SDC) for the sample period of January 1, 1970 and June 30, 2013. Issues were manually categorized as bonds, notes, debentures, other, convertible -bonds, -notes, -debentures, -preferred stock, or - other based on their 'Type Of Security' descriptions provided by SDC. U.S. non-financial and non-utility related firms issued 4,146 convertible securities (bonds,notes, debentures, preferred stock and other) between Jan 1970 and June 2013. Following the assignment of SDC data used by de Jong, Duca and Dutordoir[5] (2013), convertible bonds, notes and debentures constitute the sample of convertible debts used throughout this paper (3,148 observations). Table 4.1 details annual security issues (J1970-Jn2013), Figure 4.1 and displays trends in principal amounts, coupons, time to maturity and conversion prices for securities issued between Jan1970 and Jun2013. Table 4.2 details annual convertible debt placement by security type, on aggregate 1,320 convertible debts were privately placed.

Monthly stock related data for the period Jan,1,1970- June,30,2013 was obtained through the Center for Research in Security Prices database (CRSP). Convertible debt observations were matched to the CRSP data set by firm 6-digit cusip-ids. The sample set was reduced to maintain CRSP data for 9 months (at least 270 days) preceding the issue date of each convertible security (per issuer). Annual firm financials were obtained from the S&P Compustat database. Observations were matched by 6-digit cusip-ids and the year

[5]de Jong, Duca and Dutordoir (2013) use the SDC database to select a sample of 1,512 convertible debts issued between January 1, 1992 and December 31, 2007 by U.S. non-finance and non-utility related firms. Replication of their data set reveals that they classified convertible bonds, convertible notes and convertible debentures as 'convertible debts'. They excluded standard and convertible mortage related securities and preferred stock .

corresponding to the issue date -per security, -per issuer). 1,429 unique convertible debt issues remained after merging the SDC issuance data with CRSP stock data and Compustat firm financials.

Table 4.1: U.S. Non-Financial Security Issues: 1970-2013

Year	Cvt. Bonds	Cvt. Notes	Cvt. Debntrs	Cvt. Pref. Stock	Cvt. Other	Bonds	Debntrs	Notes	Totoal
1970	3	0	43	1	0	34	81	25	187
1971	4	0	61	3	0	36	91	21	216
1972	22	1	43	4	0	43	43	4	160
1973	5	0	4	0	0	8	23	7	47
1974	0	0	6	1	0	4	54	27	92
1975	0	0	12	4	0	21	72	63	172
1976	0	0	19	4	0	21	47	28	119
1977	0	1	13	4	0	42	58	16	134
1978	0	0	12	5	0	13	66	8	104
1979	0	0	20	11	0	19	43	19	112
1980	3	0	76	16	0	13	56	56	220
1981	2	0	65	11	0	22	49	51	200
1982	1	1	56	13	0	32	53	98	254
1983	0	4	78	51	0	38	60	64	295
1984	1	1	45	17	0	75	50	105	294
1985	17	1	87	28	5	198	110	166	612
1986	29	6	145	47	2	258	163	247	897
1987	35	4	120	33	2	248	96	183	721
1988	8	1	25	5	4	291	83	178	595
1989	11	1	40	14	9	317	63	173	628
1990	4	3	21	11	5	354	26	164	588
1991	13	13	28	19	15	361	85	387	921
1992	6	22	36	29	14	566	107	430	1210
1993	12	25	53	57	14	823	135	596	1715
1994	4	14	14	19	16	641	27	429	1164
1995	16	25	10	11	8	648	83	533	1334
1996	40	58	24	16	21	819	74	701	1753
1997	49	69	16	22	10	980	91	1131	2368
1998	5	32	20	17	27	1164	86	1272	2623
1999	0	38	8	5	17	1021	33	763	1885
2000	10	65	16	15	15	859	16	449	1445
2001	12	88	13	6	19	792	14	714	1658
2002	6	33	6	5	12	863	10	716	1651
2003	26	101	44	10	20	1056	6	765	2028
2004	17	81	25	7	10	866	1	635	1642
2005	2	50	9	17	3	842	2	455	1380
2006	21	61	10	6	3	805	4	465	1375
2007	23	72	15	9	12	879	8	538	1556
2008	1	54	1	0	5	641	1	480	1183
2009	2	77	5	17	6	1575	0	783	2465
2010	1	70	3	25	10	3139	3	903	4154
2011	1	86	4	27	10	1024	0	747	1899
2012	9	118	15	36	16	1131	5	932	2262
2013	0	75	10	24	6	640	0	497	1252
Total	**421**	**1351**	**1376**	**682**	**316**	**24222**	**2178**	**17024**	**47570**

Table 4.2: Placement of Convertible Debts, 1970-2013

	Convt. Bonds		Convt. Notes		Convt. Debentures	
Issue Year	Public	Private	Public	Private	Public	Private
1970	3	0	43	0	0	0
1971	4	0	61	0	0	0
1972	22	0	43	0	1	0
1973	5	0	4	0	0	0
1974	0	0	6	0	0	0
1975	0	0	12	0	0	0
1976	0	0	19	0	0	0
1977	0	0	13	0	1	0
1978	0	0	12	0	0	0
1979	0	0	20	0	0	0
1980	3	0	76	0	0	0
1981	2	0	65	0	0	0
1982	1	0	56	0	1	0
1983	0	0	78	0	4	0
1984	1	0	45	0	1	0
1985	17	0	87	0	1	0
1986	28	1	145	0	6	0
1987	34	1	120	0	4	0
1988	7	1	25	0	1	0
1989	8	3	40	0	1	0
1990	4	0	20	1	3	0
1991	13	0	18	10	11	2
1992	6	0	33	3	16	6
1993	10	2	41	12	14	11
1994	4	0	8	5	10	4
1995	11	5	3	7	10	15
1996	32	8	14	10	23	35
1997	25	24	8	8	19	50
1998	4	1	3	17	8	24
1999	0	0	4	4	9	29
2000	3	7	7	9	13	52
2001	2	10	4	9	23	65
2002	0	6	2	4	3	30
2003	0	26	4	40	7	94
2004	0	17	2	23	8	73
2005	0	2	2	7	5	45
2006	1	20	1	9	13	48
2007	4	19	4	11	24	48
2008	1	0	0	1	27	27
2009	2	0	3	2	47	30
2010	0	1	0	3	21	49
2011	1	0	1	3	17	69
2012	9	0	3	12	28	90
2013	0	0	6	4	19	56
Total	**267**	**154**	**1161**	**214**	**399**	**952**

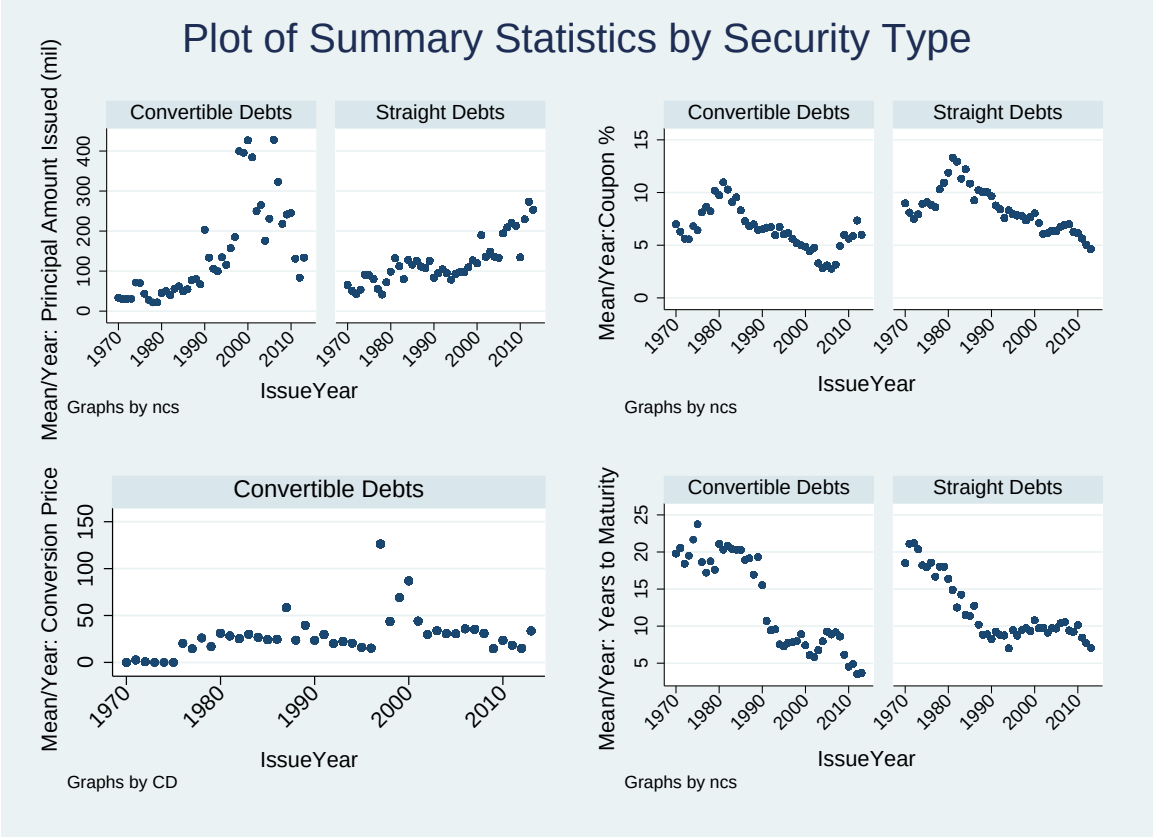

Figure 4.1: Plot of Summary Statistics by Security Type

Chapter 5: Methodology

Identifying debt-like, hedge-like, and equity-like issues

On the premise that firms select the design features of their convertible debts (i.e. maturity date, conversion ratio, coupon rate, and call provisions) they are effectively choosing how debt-, hedge- or equity-like the security will be. Since each feature affects the ultimate design of the security each component must be considered during characterization. Following Lewis, Rogalski and Seward (2003) convertible issues are classified as debt-, hedge- or equity-like based on the likelihood that the debt will be converted to equity at maturity. This probability simultaneously reflects the various design features of each security in the form of a single measure. A bond is classified as "debt-like" if the probability of conversion is less than 40%; as hedge like if the probability of conversion is between 40% and 60%; and as "equity-like" if the probability of conversion is greater than 60%. Assuming that the underlying stocks follow a Brownian motion diffusion process, each securities conversion probability value (measured from the issue date) is estimated under a standard normal distribution function $N(d_2)$. Where $N(\cdot)$ is the cumulative probability and

$$d_2 = \frac{ln(S/X) + (r - div - \sigma^2/2)T}{\sigma\sqrt{T}}$$

where, S is the current price of underlying common stock; X is the conversion price ; r is the continuously compounded yield estimated from a 10-Year U.S. Treasury Bond on the issue date; div is the issuing firm's continuously compounded divided yield for the fiscal

year-end immediately before the offer date; σ is the standard deviation of the continuously compounded common equity return estimated over the period -240 to -40 trading days prior to the issue date; and T is the number of years until maturity for the convertible bond.

Identifying hot convertible debt markets

Aggregate convertible debt volume and the criteria for hot market periods are constructed in the framework of Bayless and Chaplinsky (1996) and consistent with Dutordoir et al (2007). Aggregate convertible debt volume is calculated as a 3-month lagged moving average of the number of convertible issues offered by U.S. non-financial firms. Hot convertible markets are identified by at least three contiguous months with aggregate issuance volumes that exceed the upper quartile of the 3-month moving average of aggregate convertible issue volumes calculated between January 1970-June 2013. Table 5.1 list the hot convertible markets identified within the sample set

Identifying issuer need

Extending Dong, Dutordoir and Veld (2013 working paper), the need for external capital classified as the ratio between the amount of annual convertible principal issues and annual total assets. A firm is categorized as having a "high-need" for external capital if the principal/total assets ratio is greater than the 80th percentile of the sample ratios(0.499); a firm is classified as having a "moderate-need" for external capital if the principal/total assets ratio is between 20th and 80th percentile; and a firm is classified as having a "low-need" for external capital if the principal/total assets ratio is less than the 20th percentile (.048 ratio).

Table 5.1: Hot Convertible Debt Markets: 1970-2013

Year	Months
1980	September-November
1983	February-June
1985	June-September
1986	January-October
1987	February-August
1993	september-December
1996	February-June
1997	May-November
1998	February-April
1999/2000	December-March
2003	April-September
2003/2004	November-June
2007	February-June
2009	September-November
2011	May-July
2012/2013	May-January
2013	March-June

This table presents periods when monthly aggregated convertible debt issues exceeded the 75th percentile of the moving average of aggregated convertibles issued between January 1970- June 2013

Table 5.2: Convertible Debts by Design and Financing Need

	Cvt Bonds	Cvt Debentures	Cvt Notes	Total
Design				
Debt-like	52	69	262	383
Hedge-like	5	27	32	64
Equity-like	37	335	148	520
Total	94	431	442	967
Financing Need				
Low Need	16	35	73	124
Moderate Need	42	105	212	359
High Need	9	53	75	137
Total	67	193	360	620

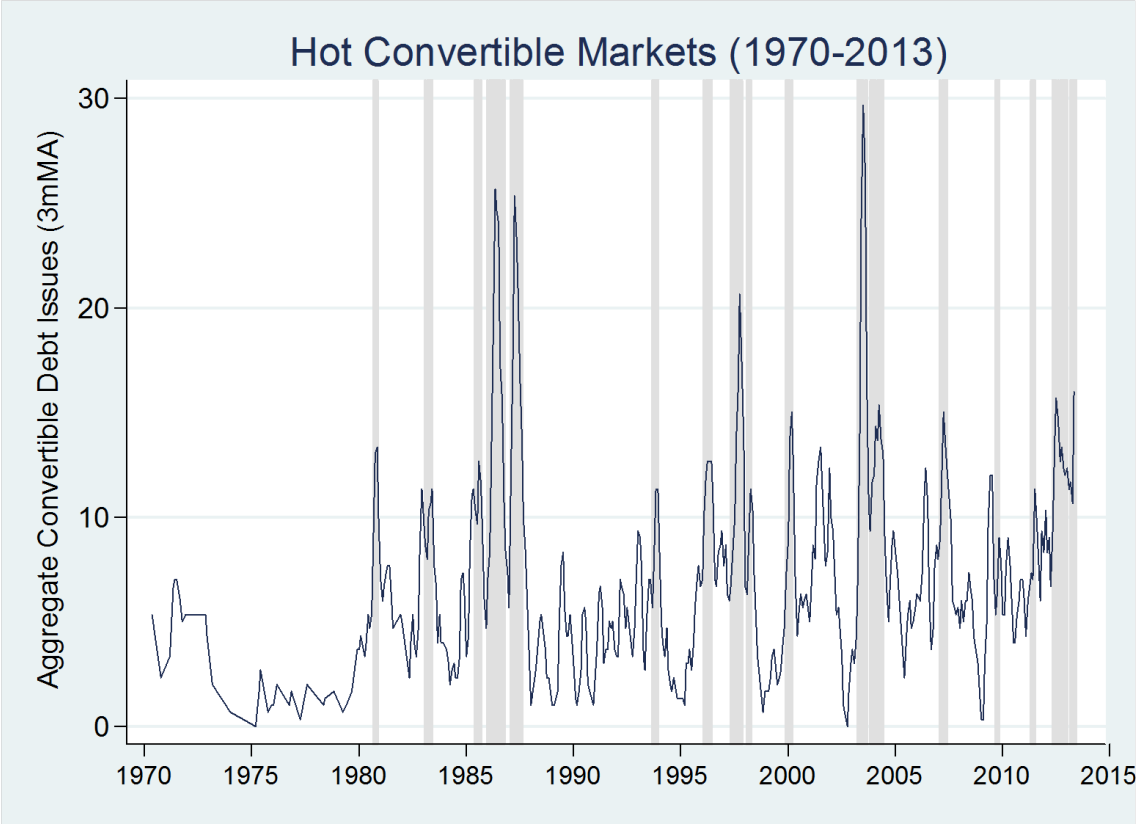

Figure 5.1: Hot Markets for Convertible Debt Issues

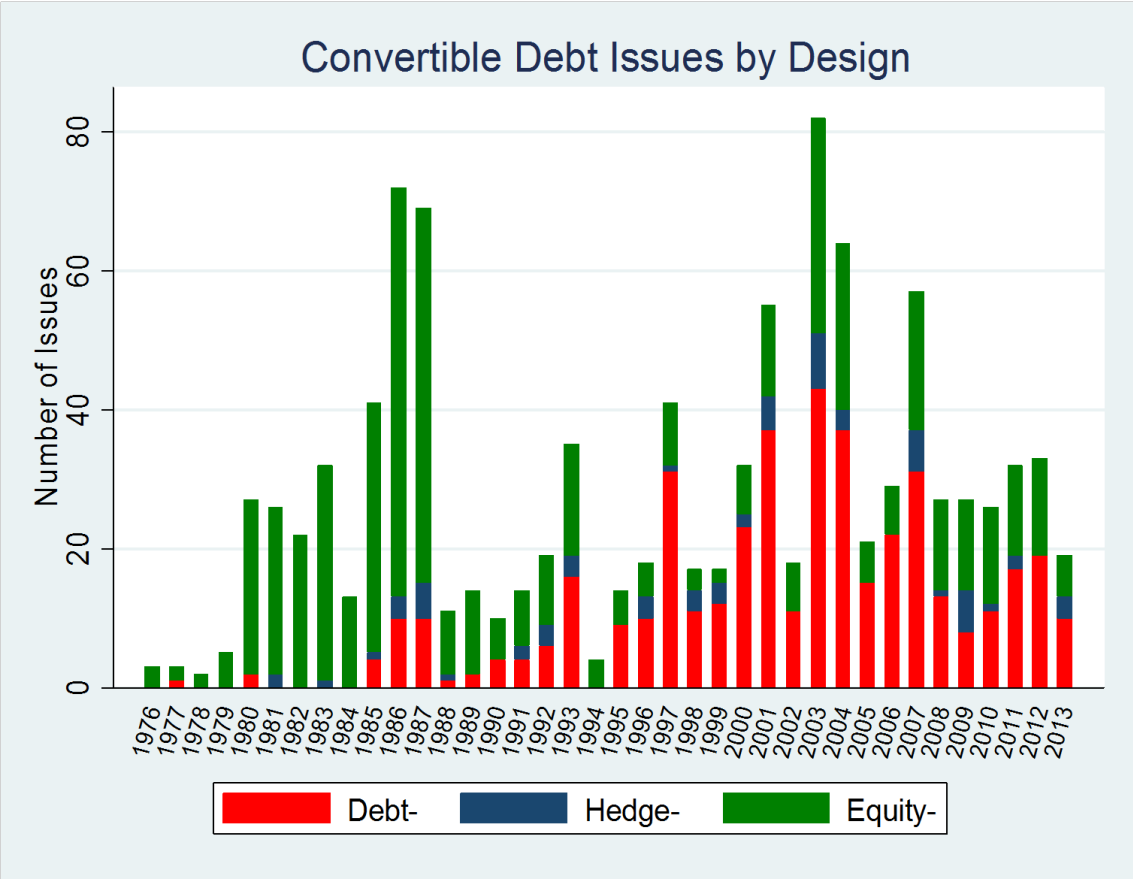

Figure 5.2: Convertible Debt Issues by Design

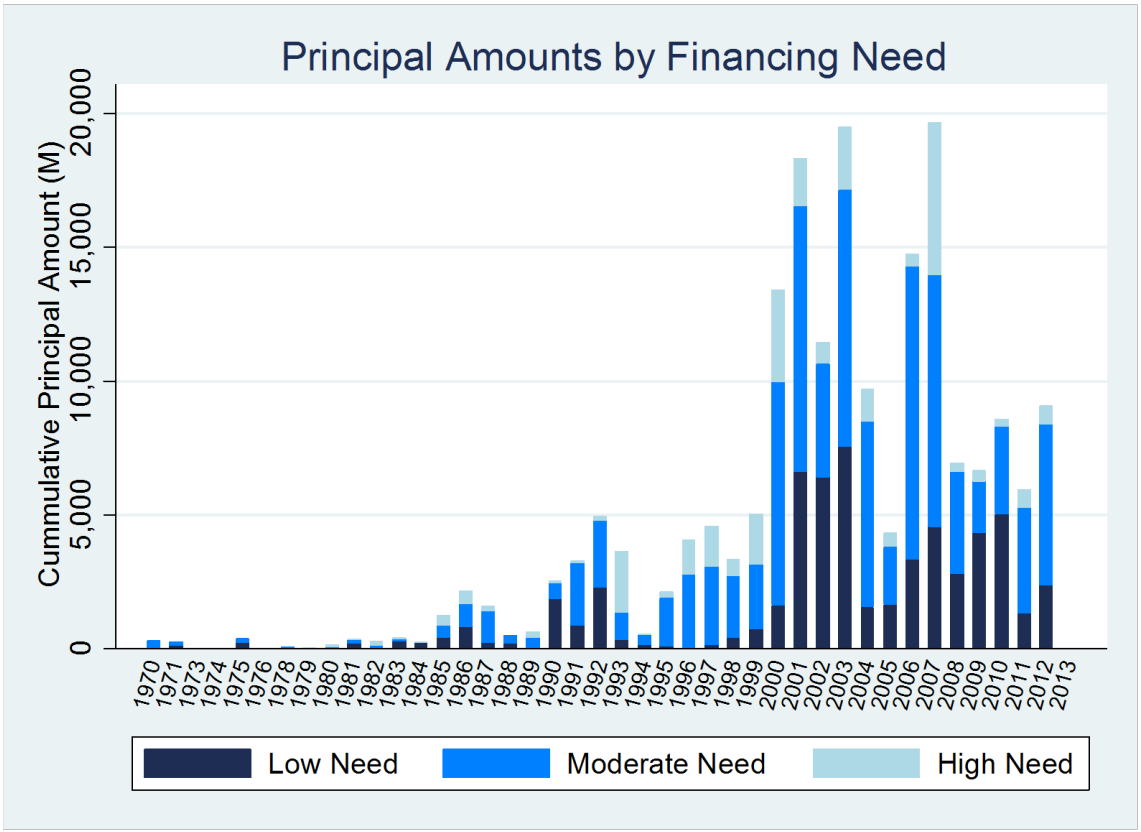

Figure 5.3: Convertible Debt Issues by Financing Need

Chapter 6: Analysis & Discussion

Logit models and Pearson's χ^2 test are used to test the three hypothesis. Note that the full sample consist of straight and convertible debt issues. In the logit analysis straight debt issue events are the 0 base and debt-, hedge-, or equity-like convertible issues are the 1 event. The Pearson χ^2 test is appropriate to evaluate the first hypothesis, that firms with the highest expected cost for new convertible debt issuance will try to mitigate their expenses by timing their issue announcement during a hot convertible debt market window. The χ^2 test for this sample of convertible debt issues and hot market windows fails to reject the null hypothesis that convertible issue designs are independent of hot (not-hot) convertible debt markets. This lack of evidence that convertible issue designs are dependent upon hot (not-hot) convertible debt markets is consistent with the Pearsonχ^2 test between convertible design and equity market conditions reported in Lewis et al (2003).

Information revealed about the prevalence of private-placement activity regardless of aggregate market conditions make this result a little unsatisfactory. Choi et al. (2009) note that, unlike publicly placed issues, the terms of privately placed convertibles may be negotiated or modified. In this light firms or arbitrage hedge funds may have strong incentives to tailor issue designs as needed. This potentially raises the question of how the composition of market participants might influence the final design features chosen.

Table 6.1 reports the test of hypothesis two, that a firm's need for external financing influences their likelihood to issue convertible debt designed as debt-like, hedge-like, or equity-like. The independent factor variable coefficients represent conditional probabilities for the event that the issuer has a high-, moderate-, or (base) low-need for external financing. The depended variables are 0/1 dummies for the convertible design

classifications. The estimates suggest that both high and low-need firms are likely to issue debt-like convertibles but high-need issuers are more than 3.5 as likely to issue debt-like convertibles than low-need issuers. The moderate and high financing need categorical variables were not significant predictors for hedge-like or equity-like design decisions. At first glance these results appear counter intuitive. If firms have high financial need, by definition at least half of their annual assets are raised through the convertible offer, we would expect them to pursue an equity-like design with the goal of conversion and capitalization. Yet the coefficient for equity-like design features by high-need firms is negative and significant at the 5% level. This theoretically conflicting result is likely due to a misspecification of financial need and blurred distinction between design features. The measure of financing need, annual convertible principals/annual assets, not only captures a firms willingness or desire to raise capital but it also reflects the time-sensitive availability or supply of capital. The regressions in Table 6 .1 do not include the market condition control of aggregate annual convertible issuance, this misspecification fails to eliminate the possibility that a firms estimated need is inflated by excess supply. Further, the fundamental motivations to select debt-like features, concerns of asset-substitution or over-investment, are very closely aligned with the motivations to issue straight debt securities. All in all the combination of a misspecified measure of financially constrained firms that choose to design debt-like issues may be simultaneously identifying issues of moral hazard and information asymmetry.

Hypothesis 3, private placement of convertible debt is prevalent and significant, regardless of the debt-,hedge-, or equity-like convertible design , is also tested using categorical (factor) logit models. The analysis is extended to the financing need and hot market factor variables. Table 6.2 shows that private placements are only statistically significant for equity-like issues but are persistent across different financing need levels. Additionally, private placements are only significant during non-hot markets (not significant during hot-markets).

These results support the notion that overcoming asymmetric information is a primary factor in choosing, if a choice exist, to privately place a new convertible issue. The literature has established that investors are less critical of asymmetric information during hot equity, straight debt, and convertible debt markets. The result suggest that private placements are not necessary for opaque issuers during relaxed hot market windows but are critical to issuers during normal or cold market periods.

This analysis considers the trends and motivations of convertible debt issuance and placement. I find that design features of convertible issues are not chosen independent to broader convertible debt markets conditions or firm-specific financial constraints. I also identify a strong relationship between private-placement activity and convertible debt issues designed with more equity-issuance characteristics. The unique features of convertible debt securities give issuers a range of flexibility to tailor their securities in a manner that mitigates or resolves firm specific concerns of asymmetric information, risk uncertainty or moral hazard.

Table 6.1: Analysis of Convertible Design and Financing Need

	All Issues	Debt-like	Hedge-like	Equity-like
	raw	controls	raw	controls
main				
omt: low_N	-0.137	-0.645*	-3.867***	-0.941**
	-0.33	-0.32	-0.64	-0.33
Mod_Need	0.298	0.758**	0.187	-0.215
	-0.24	-0.25	-0.48	-0.24
High_Need	0.35	1.146***	-0.707	-0.757*
	-0.35	-0.32	-0.75	-0.35
Market-to-Book	0.004	-0.002	-0.001	0.003
	0	0	-0.01	0
BV Comm Shrs	0	-0.000**	0	0.000**
	0	0	0	0
Net income/ total assets	5.241	-1.35	3.373	0.274
	-3.45	-2.49	-4.19	-2.56
firm size	0	0.000***	0	-0.000***
	0	0	0	0
preissue stock price runup	-0.007	-0.027***	0	0.021***
	0	-0.01	-0.01	-0.01
long-term debt/total assets	2.561***	-0.131	0.75	1.524**
	-0.58	-0.46	-0.97	-0.5
volatility	0.063	-1.219	3.802**	-2.217*
	-1.01	-0.94	-1.28	-1.11
* p<0.05, ** p<0.01, *** p<0.001				

Table 6.2: Analysis of Private Placement on Need,Design and Market Conditions

Private Placement					
Market Conditions		Convertible Design		Financing Need	
	b/se		b/se		b/se
hot-mkt	-0.15	Hedge-Like	0.123	Mod-need	0.958***
	-0.22		-0.44		-0.23
Cvt Debt Iss Vol	0.087**	Equity-like	-0.754***	High-need	1.016***
	-0.03		-0.23		-0.31
Market-to-Book	-	Cvt Debt Iss Vol	0.061*	Cvt Debt Iss Vol	0.064**
			-0.03		-0.02
Book Value of CS	-	Market-to-Book	-	Market-to-Book	-
Net income/ total assets	-0.000*	Book Value of CS	-	Book Value of CS	-
	0				
firm size	0.000**	Net income/ total assets	-0.000*	Net income/ total assets	-0.000*
	0		0		0
preissue stock price runup	-0.006	firm size	0.000*	firm size	0.000***
	0		0		0
long-term debt/total assets	0.89	preissue stock price runup	-0.001	preissue stock price runup	-0.003
	-0.46		0		0
volatility	1.251	long-term debt/total assets	0.997	long-term debt/total assets	0.990*
	-0.88		-0.58		-0.48
non-hot-mkt	-0.780**	volatility	1.295	volatility	0.976
	-0.26		-1.15		-0.9
		Debt-like	-0.441	Low-need	-1.536***
			-0.32		-0.32

* p<0.05, ** p<0.01, *** p<0.001

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